Viability and Dissemination of Mini- and Micro-Hydropower in Nepal: Development Consulting Services' Experiences

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Introduction

This paper highlights the development and dissemination of mini- and micro-hydropower (MMHP) in Nepal, with special reference to the experience of the Development and Consulting Services (DCS). DCS is a joint venture organisation of His Majesty's Government of Nepal (HMG/N) and the United Mission to Nepal (UMN), dedicated to technology development and transfer activities. There are two divisions in the organisation to perform these activities, namely, the Research and Development (R&D) Division and the Promotion and Transfer (P&T) Division. The first cross-flow turbine manufactured by the DCS was installed in Jhare *Khola,* Arghakhanchi district, in 1976. This turbine was tested on the Tinau River before installation. A second DCS turbine was installed in Kathe *Khola,* Baglung district, in 1977. Similarly, with the testing of the first Nepali-made, three-phase load controllers, the rural electrification programme started in Turture in Tanahu district. The continuing research activities of DCS are dedicated to the Automatic Voltage Regulator (AVR), Electronic Current Cut-out (ECC), Positive Thermal Co-efficient (PTC) Thermistors' switch, and Electronic Load Controller (ELC).

Installation Process

The micro-hydropower installation process consists of five steps which are described below.

Survey

On the customer's request, a survey is conducted by the installer. This involves flow and head measurements, power and cost calculations, and preparation of a report.

Project Proposal and Quotation

The DCS has developed a standard format for the MMHP project proposal which includes all project data, cost of equipment and material, installation and services, and the terms and conditions required by the Agricultural Development Bank of Nepal (ADB/N) to give loans to customers.

Loan Approval

After receiving the loan application for a given project proposal, based on the ADB/N loan officer's assessment of the economic viability of the proposal and the availability

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of adequate collateral, the loan is approved. Most of the fund is channelled through the installer.

Installation

The design of the whole scheme and its installation are the responsibility of the installer, while the civil works at the site are the responsibility of the customer.

Testing, Operation, Training, and Handing Over

After installation, the plant is run and tested, the operators are trained, and the project is handed over to the customer who will then sign the bill for final payment by the bank to the installer.

Development and Dissemination

Nine indigenous companies/firms are presently involved in manufacturing and disseminating MMHP in Nepal. They are DCS, Butwal Engineering Works and Nepal Hydro Electric Co. (BEW/NHE), Balaju Yantra Shala (BYS), Nepal Yantra Shala (NYS), Kathmandu Metal Industries (KMI), Thapa Engineering Industries (TEI), National Structure and Engineering Co. (NSE), Nepal Machine and Steel Structure (NMSS), and Nepal Power Producer (NPP). The other two companies, namely, Agro-Engineering Works (AEW) and Inter Tech (ITC) have installed 16 and six MMHP plants respectively in the past, but they are not involved in the MMHP field currently.

Most of the technical personnel in these companies worked for and were trained at the BYS or Butwal Technical Institute (BTI) before moving out to establish their own workshops for manufacturing and installing MMHP units. The total number of MMHP plants installed by these companies until 1993 was 918, of which 260 MMHPs (the largest number) were installed by DCS. Out of these 260 MMHP installed by DCS, 54 schemes are electrification schemes. The largest unit installed so far is the 100kW plant at Siklis, and a 500kW Jhankre mini-hydro scheme is under construction. The turbine is designed by DCS and manufactured by BEW/NHE. DCS-installed MMHPs are spread throughout the hills and mountains of Nepal, covering twelve zones out of the fourteen zones of the country. Over 80 per cent of all the installations are concentrated in the Western Region, and Lumbini Zone alone has about 30 per cent of the MMHP. The flow and head ranges of DCS-installed MMHPs lie respectively within three to 107/sec and 17 to 122 metres. The total power generation from DCS installations is estimated to be 730kW, and about 50,000 people have benefitted from the DCS electrification programme alone. In 1994, a further 492kW of power will be generated by DCS installations.

Promotion and Application of MMHP in Nepal

In addition to private companies, a number of government, semi-government, and non-government organistions are involved in the promotion of, development of, manufacturing of, research into, and policy-making for MMHP. At the central level, the

National Planning Commission (NPC) and the Water and Energy Commission Secretariat (WECS) play their respective roles in planning and policy formulation, while the Research Centre for Applied Science and Technology (RECAST) and the Royal Nepal Academy of Science and Technology (RONAST) are involved in technology development. ADB/N has played a leading role in the financing aspect. Government subsidies of 50 to 75 per cent of the electrical equipment costs are being channelled to developers through this bank. The other organisations involved are the International Centre for Integrated Mountain Development (ICIMOD), the Intermediate Technology Group (ITDG), the German Technical Cooperation (GTZ), and the Swiss Association for Technical Assistance (SATA)-Helvetas, at present.

The applications of MMHP in Nepal are primarily in the agro-processing activities of rural areas. Electricity-generating MMHPs were introduced in 1984. Low-wattage cookers (*Bijuli Dekchi*) and oil expellers are the end-use devices developed and promoted by DCS.

Issues and Possible Solutions

The problems encountered during the promotion of MMHP technology are many. Lack of good testing facilities, lack of MMHP standards, uncertainty about the provision of subsidies, high initial costs, inadequacy of users' knowledge, and unavailability of spare parts are a few of these problems.

The possible solutions to them could be: (i) imparting repair and maintenance training to the operators/users; (ii) opening either a local sales' depot or selecting a local commission agent for selling or making available the accessories/spare parts in the field; (iii) providing a fixed amount of subsidy for a fixed time period; (iv) conducting consumer education and mobile training programmes; and (v) rewarding the successful owner/promoter/operator periodically.

Conclusions and Recommendations

The MMHP sector has made remarkable progress; it installed more than 918 units by 1993. Twenty-eight per cent of these installations were commissioned by DCS. About 50,000 people have benefitted from DCS plants alone. DCS is shifting its emphasis from agro-processing mills to MMHP for electrification. The experience of DCS shows that: (i) the success of MMHP development and dissemination depends on the ability to cater to the needs of the people and on making MMHP affordable for users and (ii) the technology could be transferred only to those areas where a minimum conducive physical environment prevails for development and uses of MMHP.

The following are recommendations that will help the development and dissemination of MMHP technology in Nepal.

1. The equipment to be distributed should be fully developed in keeping with standard specifications.

2. A desirable training package should be provided to users/operators, as well as installers, on a regular basis.
3. A simple mechanism for loans and subsidies should be developed.
4. Follow-up visits by the manufacturers should be undertaken.
5. An evaluative study should be carried out in order to see the performance of the MMHP units. Quality control and standardisation of the product should receive focus.
6. There is a need for better coordination among agencies involved in MMHP.
7. An active Micro-Hydropower Development Association is needed. Otherwise an institution needs to be set-up to organise meetings, seminars, training and coordinating, promoting, monitoring, and evaluating the MMHP programme.
8. End uses suitable for hill communities should be developed.
9. Programmes aimed at increasing the awareness of the rural population about MMHP should be organised.
10. R&D need to be undertaken to improve the performance of the existing end-use appliances.
11. An operational manual should be prepared and distributed to the owners for the successful operation and maintenance of each plant.
12. An MMHP newsletter should be published and distributed widely.